

PROCEEDINGS OF THE LINNEAN SOCIETY OF LONDON

148th Session (1935-6)

Part 4

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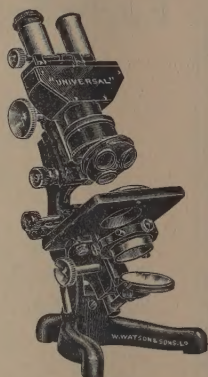
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PROCEEDINGS OF THE LINNEAN SOCIETY OF LONDON

148th Session (1935-6)

Part 4

ANNIVERSARY MEETING

28 May 1936

Dr. W. T. CALMAN, C.B., F.R.S., President,
in the Chair

The Proceedings of the previous meeting, held on Thursday, 7 May 1936, having been circulated, were taken as read and confirmed.

A list of names of those who had made gifts to the Library since the previous meeting was read and laid on the table.

The following Fellows signed the Obligation in the Book of the Charter and Bye-Laws and were admitted:—Neil Alison Mackintosh, Ivan Mackenzie Lamb and Thomas Edward Hughes.

A certificate of recommendation of the following candidate for Fellowship was read:—For the first time, in favour of Charles Edmund Ford.

The Treasurer presented his Financial Report and the Accounts of the Society, duly audited, for the year 1935-36.

On a motion by Dr. H. HAMSHAW THOMAS, seconded by Dr. MALCOLM A. SMITH, the Report and Statement of Accounts were adopted.

The Bye-Laws regulating the Election of Council and Officers having been read by the Clerk, the PRESIDENT declared the Ballot for Council and Officers to be open, and voting began. The Ballot for Council was closed at 5.30 p.m. and for Officers at 6.0 p.m.

Meanwhile the Clerk presented the usual Report of the Librarian and Assistant Secretary.

Issued 18 December, 1936]

LIST OF THE SOCIETY.—Since the last Anniversary Meeting the Society has lost thirty-one members. The detailed statement is as follows :—

9 FELLOWS BY DEATH :—Richard Bentley, John Cameron, George Alexander Gammie, Cuthbert Chapman Gibbes, John Kitching, Ida Mary Roper, Reginald William Scully, Donald Herbert Edmund Sunder, Lord Wakehurst of Ardingly.

4 FOREIGN MEMBERS BY DEATH :—Henry Fairfield Osborn, Benjamin Lincoln Robinson, Friedrich August Ferdinand Christian Went, Friedrich Zschokke.

1 ASSOCIATE BY DEATH :—Arthur Patterson.

11 FELLOWS BY WITHDRAWAL :—Bernard Cuthbert Ellison (see report for 1930–31), George Allan Frost, William Frederick Neville Greenwood, John Henry Holland, Eileen R. L. Johnson, John Graham Kerr, James Oliver, Ethel Katherine Pearce, Raymond Henry Stoughton, Rose Haig Thomas, John Claude Waller.

6 FELLOWS BY REMOVAL :—Raghunath Prasad Asthana, Herbert William Cousins, Edavaleth Kakkat Janaki-Ammal, William George Freeman, Niranjana Mukerjee, Percy George Netley.

During the Session 5 Foreign Members, 1 Associate, and 26 Fellows have been elected. Of the 26 Fellows elected, 25 have qualified. A further 4 Fellows have qualified who were elected during the Session 1934–35.

The present number on the List of Fellows is 736, with 1 Fellow elected, but not yet qualified.

LIBRARY.—Between 1 May 1935 and 30 April 1936 20 books have been purchased and 47 books, 429 parts of periodical publications, and 145 reprints have been presented. During the same period the number of volumes bound was 559. The number of volumes borrowed by Fellows and Associates was 889, and by the National Central Library 181. On the other hand, 6 volumes were borrowed from the Science Library for the use of Fellows. 858 signatures were recorded in the Library Visitors' book, inclusive of 87 for Saturday afternoons.

Mr. A. W. Sheppard has again rendered valuable assistance as an unofficial worker in the Library.

LINNAEAN COLLECTIONS.—Between 24 May 1935 and 28 May 1936 the collections have been consulted 78 times by visitors: the Herbarium 53 times, 98 genera having been examined; the zoological collections 15 times; the remaining 10 visitors having taken a general view of the whole. These figures for consultations do not include two visitors who spent a considerable time working here. The first of these, Dr. Harald Lindberg, of Helsingfors, worked through all the northern genera in the Herbarium. The second, Dr. Arvid H. Uggla, Secretary of the Swedish Linnean Society, worked for two months on the Linnaean MSS.

At the conclusion of this report, the PRESIDENT appointed Mr. T. A. Dymes, Mr. H. N. Ridley, and Mr. A. W. Sheppard as Scrutineers of the Ballot.

In handing the Linnean Gold Medal to Professor JOHN STANLEY GARDINER, F.R.S., the President addressed him in the following words:—

Professor STANLEY GARDINER, The Council of the Linnean Society have resolved by unanimous vote to award you the Linnean Medal for this year. In doing so they had in mind not only your own original contributions to the science of zoology, but more especially the great services you have rendered to the study of biology in general by the long series of expeditions which have owed their existence to your organizing ability, and their success to your enthusiasm and power of leadership. I believe the first expedition in which you took part was that to the Island of Funafuti, when the first attempt was made to ascertain by boring the structure of a coral island. Later you led the expedition to the Maldives and Laccadives, and the important results obtained were recorded in a series of volumes published by the Cambridge Press. Of your later expedition in H.M.S. *Sealark* to the Indian Ocean and to the Seychelle Islands, we are proud of the fact that you chose our 'Transactions' as your vehicle of publication.

In addition to these we know that you were largely responsible for the initiation and the organization of the Great Barrier Reef expedition, 1928-29, of the 'John Murray' expedition to the Indian Ocean, 1933-4, and of the Cambridge expedition to the Great African Lakes in 1930-1, not to speak of numerous other journeys of exploration carried out by single individuals or small groups of your pupils at your instigation and with your help.

Most of your voyages have been undertaken with one main object in view, the elucidation of the structure, the

origin, and the development of coral islands. This has led you to study also the morphology, the systematics, the physiology, and the ecology of the coral polyps themselves, and so to consider the broad problems of marine ecology in general, on all of which subjects you have made substantial contributions to knowledge. You have given an admirable survey of the whole subject in your book 'Coral Reefs and Atolls', published in 1931.

In another way your influence on the teaching of zoology in this country has been great. The Department of Zoology at Cambridge has not only increased in size, but has greatly widened its scope under your direction. I believe that you initiated the study of experimental Zoology in Cambridge where it now forms a sub-department under your professorship. The sub-department of entomology similarly has come into existence under your hand.

Finally, those of us who have seen the splendid new building in which your Department is now housed cannot help mingling envy with our admiration.

In reply, Professor STANLEY GARDINER expressed his profound appreciation of the honour that had been conferred upon him.

In the introductory passage to his Address the PRESIDENT said :—

Before proceeding to deal with the subject matter of my address I conform to the custom of the Society in making a few remarks on the events of the past year.

In the first place, we rejoice to know that our Assistant Secretary, Mr. S. Savage, is making a good recovery from his recent severe illness. To him, and to the other members of our staff, but above all to the honorary officers of the Society, our gratitude is owed for the time, labour, and skill with which they have continued to direct our affairs.

Two parts of our 'Proceedings' have now been issued in the new form, and I think that the changes made have met with general approval.

We have been informed that the Society will benefit by a sum of money under the will of the late Mr. Herbert Spencer, and since the close of the financial year the sum of £500 has been received on account. Under the terms of the will this must be spent within a limited period, but I do not think your Council will have any difficulty in finding suitable objects on which to spend it.

The losses that our Society has suffered by death during the year have shown a very welcome reduction in number, although as usual we have to deplore the loss of several

whose names are familiar not only within our Society, but in wider circles of the scientific world. All of these will receive fitting commemoration in a forthcoming number of our 'Proceedings', and I need only mention here Lord Wakehurst of Ardingly, a former President of the Horticultural Society, and for several periods a member of our own Council, and one of our Vice-Presidents. He was one of those who have done much to maintain the traditional association between our Society and the gardening world. Miss Ida Mary Roper, of Bristol, and Mr. Reginald William Scully, of Cork, were field botanists of more than merely local reputation.

Of the foreign members who have died during the year Professor Henry Fairfield Osborn was unquestionably one of the most outstanding figures among the American biologists of our time. From his student days a frequent visitor to this country, he was almost as well known in London as in New York. Another distinguished American, Professor Benjamin Lincoln Robinson, was a well-known systematic botanist, and head of the Gray Herbarium at Harvard. Dr. Friedrich August Ferdinand Christian Went was an eminent Dutch botanist, especially distinguished for his researches on the physiology of plants. Professor Friedrich Zschokke was well known for his researches on parasitology and on the freshwater fauna of Switzerland, especially of the High Alps.

Mr. A. H. Patterson, who was elected one of our Associates only a year ago, was known to a wide circle of readers by his delightful books on the natural history of Norfolk.

The PRESIDENT then delivered his Address, 'The origin of insects'.

On its conclusion, Sir SIDNEY F. HARMER, K.B.E., F.R.S., moved 'That the President be thanked for his excellent Address, and that he be requested to allow it to be printed and circulated amongst the Fellows'. The motion was seconded by Dr. A. B. RENDLE, F.R.S., and being put to the meeting was carried with acclamation.

The Scrutineers of the Ballot, who had retired at the appointed times with the voting-lists for the election of the Council and of the Officers, having completed their scrutiny, reported to the President, and he declared the result as follows:—

COUNCIL FOR 1936-37.—Dr. Eric Ashby; Dr. B. Barnes; Dr. W. T. Calman, C.B., F.R.S.; Capt. Cyril Diver; Mr. Francis Druce; Mr. S. Garside; Mr. M. A. C. Hinton, F.R.S.; Dr. J. Hutchinson; Dr. Stanley Kemp, F.R.S.; Dr. Margery

Knight; Mr. Ashley G. Lowndes; Prof. R. C. McLean; Mr. Charles Oldham; Mr. John Ramsbottom, O.B.E.; Mr. D. J. Scourfield, I.S.O.; Lt-Col. R. B. Seymour Sewell, C.I.E., F.R.S.; Prof. Macgregor Skene; Dr. Fred Stoker; Dr. W. H. Wilkins; Dr. E. B. Worthington.

(The retiring Councillors were The Lord Aberconway, C.B.E., Prof. G. D. Hale Carpenter, M.B.E., Mr. H. A. Hyde, Prof. E. W. MacBride, F.R.S., and Dr. Hugh Scott.)

OFFICERS FOR 1936-37.—*President*; Dr. William Thomas Calman, C.B., F.R.S.; *Treasurer*: Mr. Francis Druce; *Botanical Secretary*: Mr. John Ramsbottom, O.B.E.; *Zoological Secretary*: Dr. Stanley Kemp, F.R.S.

The PRESIDENT then announced that he appointed the following as the Vice-Presidents for 1936-37:—Mr. Francis Druce, Dr. John Hutchinson, Dr. Margery Knight, and Lt.-Col. R. B. Seymour Sewell, C.I.E., F.R.S.

Thereafter the President declared the Session of 1935-36 closed.

PRESIDENTIAL ADDRESS.

By DR. W. T. CALMAN, C.B., F.R.S., P.L.S.

THE ORIGIN OF INSECTS.

(With 5 Text-figures.)

IN addressing this Society a year ago, I attempted to maintain the importance of Phylogeny as a legitimate and, indeed, necessary subject of biological study. I pointed out the constant interference of convergent evolution, obscuring and confusing the morphological evidence of descent, and I appealed to the results of taxonomy to show that convergence, although everywhere apparent, had not played the dominating part that some had supposed in the evolution of the animal kingdom.

Following the same line of thought, it may not be unprofitable to give some attention to one of the major episodes in the history of animals, the Origin of Insects. In the time at my disposal it would not be possible, even if I possessed the necessary knowledge, to give the barest summary of the facts that are known or of the hypotheses that have been put forward on this much discussed subject; nor have I any new facts to put before you or novel conclusions to suggest. Nevertheless, looking at the matter from the point of view of one who is not an entomologist, there are one or two considerations that do not seem to have received adequate attention, although they may have a very important bearing on our discussions.

Leaving aside the hypothesis that there may have existed in the earlier geological epochs a terrestrial fauna of which no trace has come down to us, the insects represent probably the first and certainly the most successful attempt of animals to adapt themselves to an air-breathing existence. At the present time the known species of insects are estimated to outnumber, by something like two to one, those of all the other classes of the animal kingdom put together, and it is suggested that, considering the land fauna alone, the great bulk of animal matter in the world is contained in the bodies of insects. Until the vertebrates followed them from the water to the land, the insects can have had few serious competitors in the new environment and perhaps it is not yet decided which of the two groups is to be finally victorious. At all events man still finds in insects his most dangerous rivals for the occupation of vast regions of the earth, and everywhere they remain a menace, still unsubdued, to his well-being if not to his very existence. It was not without

reason that the prince of the devils was named Beelzebub, lord of flies.

In countless ways the appearance of insects influenced, for good and for ill, the whole after history of the living world. It can hardly be doubted, for example, that they played a great part in the evolution of flowering plants, although over-elaboration of the theme has sometimes played into the hands of the sceptics.

When we enquire how and where this momentous event took place, we can find only hesitating and equivocal answers. The palaeontological record, as we shall see presently, is exceedingly scanty. The evidence from comparative morphology and embryology is more than usually obscure, and the conclusions that have been drawn at various times are mutually contradictory.

And yet, up to a certain point, the evidence of morphology is clear and definite. On a broad survey, the vast range of structural diversity found among insects is plainly limited by a common ground plan. It is far easier to draw a typical insect than, say, a typical crustacean. We have only to eliminate, according to well-understood rules, the specializations proper to the various Orders, Lepidoptera, Hymenoptera, Diptera, and so forth, and the residuum, the 'greatest common measure' of all insects as it were, stands forth, not as some vague and shadowy entity barely conceivable as a living organism, but a recognizable insect not so very unlike a common blackbeetle. In other words, there can hardly be any dispute that, on the evidence of comparative morphology alone, the insects are a monophyletic group derived from a primitive stock from which the existing cockroaches have not diverged very widely.

As far as it goes, the palaeontological evidence supports this conclusion and even carries it a little further. In the rocks of the Carboniferous epoch we find what were, until recently, the earliest known fossil remains of insects. They include primitive Orthoptera, some of which seem not to differ very widely from the existing cockroaches, and numerous forms referred to a wholly extinct Order, the Palaeodictyoptera which are only a little older and more primitive than these.

The serious difficulties begin when we try to go behind this point. These ancient insects were already provided with wings. What can we suppose their wingless predecessors to have been like, and how are they to be linked up with the other divisions of the Arthropoda?

The late Professor Handlirsch in his great work on fossil insects put forward and expounded with great persuasiveness the view that the Palaeodictyoptera may have been derived directly from trilobites. Into the arguments for and against

this view I cannot enter in detail, but there are two points that seem to deserve mention. The trilobites are extremely primitive Arthropoda as far as the structure of their limbs is concerned, and it is not too much to say that they might be regarded as ancestral to most of the other groups of the phylum. The gap separating them from insects is far wider than that between them and the more primitive crustacea for example and we have no hint as to how it is to be bridged.

Among the distinctively trilobitan characters made use of by Handlirsch in attempting to establish the derivation of winged insects is the fact that the segments of the body in trilobites have laterally projecting side-plates or pleura marked off from the middle part of the segments by grooves. Handlirsch supposes that the insect wings arose as further expansions of these side-plates on the second and third thoracic somites (figs. 1 and 2).

It should be pointed out, however, that the possession of expanded side-plates is by no means confined to the trilobites. Among the various orders of crustacea, whenever the body is flattened from above downwards, there is a tendency for the side-plates to be conspicuously broadened. Among the Isopoda this is notably the case and in them the exaggeration of the coxal or pleural plates often leads to a close but misleading resemblance to a trilobite that has been often commented on.

The view that insect wings originated as a further development of expanded pleural side-plates which became movably articulated with the body is probably correct, but the reasons for looking to the trilobites for their origin are of doubtful weight.

Handlirsch's theory is based on the assumption that the earliest insects possessed wings. In his view, the existing wingless insects forming the group Apterygota are degenerate, having been derived from winged ancestors. From this, I believe, the majority of entomologists would dissent, regarding the Apterygota, and especially the Thysanura, as primitively wingless, and as representing a stage in phylogeny when all the main characteristics of the Insecta had been acquired with the exception of wings.

One of the earliest schemes of insect phylogeny, that of Brauer, started from the thysanuran *Campodea* (fig. 3). The species of this genus are wingless and eyeless insects, for the most part minute, and they resemble, in their adult stage, a type of larva that is found in insects of several different Orders, the so-called 'campodeiform' larva. *Campodea* further shows a number of important similarities to certain primitive myriopods forming the Order Symphyla, such as *Scolopendrella* (fig. 4), and it has been argued that together they point to a common stock from which the insects and the myriopods

have been derived. Tillyard, for example, concludes that, except for one serious difficulty, 'there has never been presented any theory of the origin of insects having so many definite points in its favour'.

The one difficulty alluded to concerns the position of the reproductive openings. In all insects these openings are near the hinder end of the body, generally, but not always, on the pre-anal somite. In the Symphyla, on the other hand, and in the millipedes, the genital openings are placed far forward on the third or fourth somite behind the head.



FIG. 1.—Handlirsch's hypothetical Protentomon, a primitive insect type based upon the characters of the Palaeodictyoptera. (After Handlirsch.)

This difference has been supposed to be of fundamental importance, the Symphyla and Diplopoda (millipedes) being separated as Progoneata from the Opisthogoneata, comprising the Insecta and Chilopoda (centipedes).

A survey of the other Arthropoda, and especially of the Crustacea and Pycnogonida, suggests that there has been a tendency for the place of emergence of the genital ducts to remain constant while the revolutionary changes have taken place in other parts of the organism, but that this stability has broken down again and again in the course of evolution.

In the Crustacea the openings may be as far forward as the first somite behind the head or as far back as the twentieth. In the Pycnogonida the openings may be present on the basal segments of one pair or of all four (or five or six) pairs of legs. Since the position is not exactly the same, within the limits of two or three somites, either in the Progoneata or in the Opisthogoneata, the reason for regarding the difference between the two groups as fundamental is greatly weakened.

I may digress a little here to deal with an argument that has been put to me in conversation, and may, for all I know,

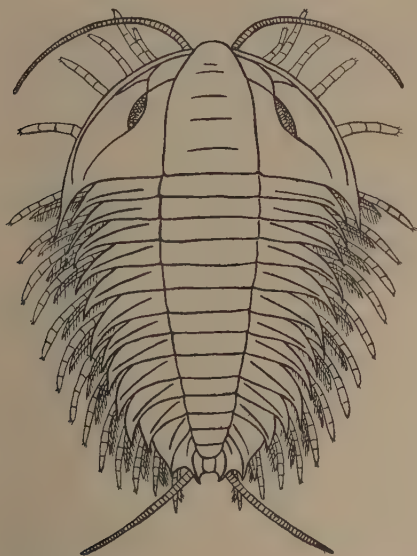


FIG. 2.—Reconstruction of a Trilobite, *Neolenus serratus*.
(After Handlirsch.)

have been developed by some writer whose work has escaped my notice. It is that evolution in any group of animals is accompanied by increase of size, that the ancestral insects must therefore have been minute, and that it is useless to look for ancestral characters in anything as big as a cockroach or even in the larger Thysanura such as *Machilis*. The idea appears to have been suggested by the fact that in terrestrial vertebrates, and especially in mammals, many lineages show progressive increase of individual size with advancing evolution.

There appears to be not the slightest justification, however, for extending this generalization to insects. Some of the carboniferous insects were gigantic as compared with any now living. It is even suggested that one of the factors that has contributed to the success of insects in the struggle for existence is that they have avoided the megalomania that has led to the extinction of many other groups. Further, a study of various groups of Arthropoda gives reason for believing

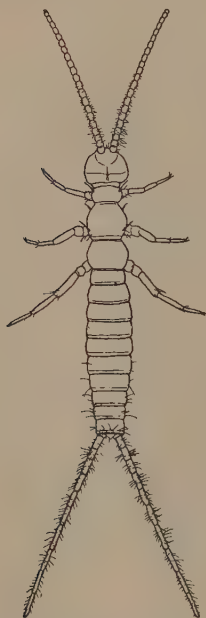


FIG. 3.—*Campodea staphylinus* Westwood. (After Lubbock.)
Length of body 2.8 mm.

that there is a limit of size below which morphological differentiation is unable, as it were, to find adequate scope for expression. In discussing the minute syncaridan *Bathynella*, for example, I pointed out that in very small Crustacea there is a tendency for the number of segments in the appendages to be reduced, while the segments themselves are more elongated, the bristles with which they are provided are fewer in number and larger in relative size, and the smaller appendages show a clumsiness of modelling and a tendency to rounded

outlines when compared with those of related but larger species (fig. 5). Following D'Arcy Thompson, I suggested that some of these differences might be attributed to the greater part played by intermolecular forces such as surface tension in determining the form of organisms and organs below certain limits of magnitude. These limits are, of course, ill defined and will certainly be different for aquatic and terrestrial organisms ;

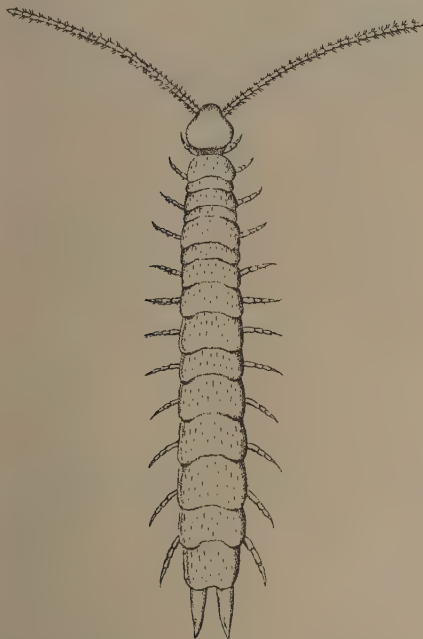


Fig. 4.—*Scolopendrella immaculata* Newport. Copy of Newport's original figure in Trans. Linn. Soc. London, xix, pl. xl, fig. 4, 1845. Actual length 5 mm.

but I have suggested that it is just about where we begin to apply the term microscopic, in common speech, that the effects of intermolecular forces begin to be conspicuous. Just as, when we approach the lower limit of microscopic vision, with bacteria and the like, morphology seems to disappear, and the morphologist must hand over the subjects of his study to the molecular physicist and the chemist.

At all events, it seems probable that, in attempting to estimate the phylogenetic value of characters, regard should be had to the size of the organisms displaying them. Where structures or organs are ill-developed or absent in an animal of small size it may sometimes mean only that there is not space for them to develop properly. Thus, for example, in the case of *Bathynella*, we should attribute much phylogenetic importance to the positive character that its first thoracic somite is free from the head, but little importance to the facts that its appendages have few segments and its mouth-parts are imperfectly formed. Similarly, although *Campodea* and *Scolopendrella* are a good deal bigger they are still small enough to discount the absence or imperfect development



FIG. 5.—Maxillulae of *Anaspides* (A) and *Bathynella* (B), enlarged to about the same size. The actual length from base to apex of the maxillula of *Anaspides* was 2.2 mm.; that of the maxillula of *Bathynella* was about .06 mm.

of some features that we should expect to find in phylogenetically primitive forms.

It was, I think, our distinguished Foreign Member Dr. H. J. Hansen *, who first called special attention as long ago as 1893 to certain remarkable coincidences in structure between insects and the higher crustacea. He gave particular attention to the thysanuran *Machilis* and pointed out that the structures which had been termed 'paraglossae' in the mouth-parts had a close similarity to the first maxillae or maxillulae of crustacea, with which he pronounced them to be homologous. The importance of this was that it enabled the head of insects to be compared, somite for somite, with that of the so-called sessile-eyed crustacea in which also there are three pairs

* Dr. Hansen died on 26 June 1936.

of head-appendages behind the mandibles. Unfortunately, the study of insect embryology has so far failed to produce any clear evidence of a somite corresponding to Hansen's maxillulae. It is most desirable, as Tillyard points out, that the embryology of *Machilis* should be studied with particular reference to this point.

Hansen, in his long-continued researches on the morphology of Arthropoda, rigidly abstained from phylogenetic speculations. He believed, as did T. H. Huxley, that it was possible to construct a system of morphology quite apart from theories of descent. Most of us, however, find it impossible to form any kind of satisfying mental picture of morphological relationships without a background, however shadowy, of phylogenesis, and it is very difficult to fit in some of Hansen's comparisons with such a background. For example, he shows that the mandible of *Machilis* resembles that of certain Cumacea, not only in its form but even in the arrangement of its muscles. The Cumacea, however, are a very specialized group of Crustacea. It seems inconceivable that these resemblances in the mandibles can have persisted unchanged from any ancestral form that they can possibly have shared with insects. In other words, these similarities, striking though they are, must be the products of convergent evolution. So also with the many resemblances that have been pointed out between insects and the 'sessile-eyed' crustacea, especially the Amphipoda and Isopoda. In the Amphipoda, for example, the maxillipedes are fused together in the middle line and present a remarkable analogy with the labium or second maxillae of insects, with which, on Hansen's interpretation, they are homologous. Both the Amphipods and the Isopods include forms that have successfully invaded the land, the talitrid sandhoppers and the oniscoid woodlice, and it is just among these that the insectan resemblances become most conspicuous, even to the development of 'pseudotracheae' in many woodlice. There is one obvious fact, however, that warns us against too hasty attribution of these resemblances to genetic affinity. Both sandhoppers and woodlice appear at first sight to have, like insects, only one pair of antennae; but in the crustacea it is the second pair of antennae that are conspicuous, the first being reduced or quite vestigial, while in insects, on the other hand, the antennae correspond to the first pair, the second pair, belonging to the intercalary somite of the embryo, having quite disappeared*.

Any attempt to give precision to the vague idea of affinity between insects and the higher crustacea encounters a far

* Tillyard, by a slip, states that the *second* antennae are lost in the oniscoid Isopoda.

more serious obstacle in the fact that each of these groups has a well-defined and apparently firmly established metameric pattern from which neither shows the slightest indication of departing. In the insects the thorax of three somites bearing walking legs is always sharply differentiated from the abdomen of eleven or twelve somites, with the abdominal appendages, if present, widely different from those of the thorax. In the malacostracous crustacea the distinction between thorax and abdomen is no less constant and clear, but the former consists of eight somites and the latter of six or seven.

It is generally assumed that when, in the course of evolution, a uniform series of somites or appendages has become differentiated, by the operation of what Lankester called 'tagmosis', into groups of similarly modified units, the process cannot be reversed so as to give rise again to a uniform series. As far as we have any evidence on the subject, this assumption is probably justified, and, if so, we cannot suppose that the metameric pattern of the Malacostraca can have been obliterated so as to give rise to a form like *Scolopendrella* with a series of undifferentiated appendages which might again become differentiated into the pattern of the insect body.

It is also assumed that when, in the Arthropoda, at any rate, a metameric pattern has become established, there can be no shifting of the boundary between adjacent tagmata such as would permit the eight thoracic plus seven abdominal somites of the Malacostraca to be transformed into the three plus twelve of the insect. I must confess to a suspicion that this assumption may not be so well established as the other. Something very like this process is assumed to have happened frequently in the evolution of the Vertebrata, and I have elsewhere ventured to suggest, in discussing the affinities of the Pycnogonida, that such disturbances of an established metameric pattern may have occasionally played a part in the phylogeny of the Arthropoda also. By this time, however, we have wandered a good way into a region of pure (some would say mere) speculation, and it is advisable to get back to the solid ground of fact. We must note that, if the Malacostraca cannot have given rise to insects, many of the evidences of affinity between crustacea and insects lose their point and we are left with little more than the coincidence of the pre-mandibular somites in the two groups and, especially, the wonderfully close agreement in the structure of the compound eyes.

At the time when Handlirsch wrote, the earliest fossil remains that could be definitely asserted to be those of insects belonged to the Carboniferous period. Ten years ago, however, the late Mr. S. Hirst and Mr. S. Maulik described

certain remains from the Middle Devonian that were tentatively assigned to insects. They were found in the chert deposit of Rhynie, in Aberdeenshire, well known for the marvellously preserved plant remains contained in it and for the remarkable crustacean *Lepidocaris* described by Mr. Scourfield. The more important of these supposed insect remains were four imperfectly preserved heads to which the name *Rhyniella praecursor* was given by Hirst and Maulik. Later, the specimens were investigated by Tillyard, who definitely referred *Rhyniella* to the Collembola and stated that it was closely allied to the family Poduridae. He added, 'it seems very unlikely that the thorax or abdomen of any of these fossils will ever be found, judging by the macerated condition of the head-capsules so far discovered'. Most fortunately this prophecy has proved false. Mr Scourfield has discovered and will shortly describe a specimen in which the head of *Rhyniella* is associated with part of the body and the legs. This specimen fully confirms, if any doubt remained, the insectan nature of *Rhyniella*, it corroborates Tillyard's attribution of it to the Collembola, and only the unlucky absence of the tail end leaves in doubt its podurid affinities, for we do not know whether *Rhyniella* possessed the forked jumping organ which has given the Collembola the name of Springtails.

It was no doubt the discovery that the oldest fossil insect was allied to the Collembola that suggested to Tillyard his theory of the origin of insects which places the Collembola at the very base of the series. His arguments, however, seem far from convincing. Not only the reduced number of abdominal somites but the specialization of the abdominal appendages indicate that the Collembola are less primitive than the Thysanura. There is, of course, not the smallest reason to suppose that *Rhyniella* was the only insect existing in the Middle Devonian. The Rhynie chert seems to have been formed in quite exceptional conditions, probably in a swamp that was periodically flooded with silica-laden water from a hot spring or geyser. As a result, we get, as it were, a momentary glimpse of a whole fauna of Crustacea, Insects, and Arachnids, of which we should not otherwise have had any trace. There were doubtless other insects of which we know nothing. There may even have been winged insects, although there is a good deal of probability in Tillyard's suggestion that the power of flight is unlikely to have been acquired in a treeless world.

On the whole, then, while it is impossible to speak with confidence, it seems reasonable to suppose that the earliest insects were wingless forms not very different from the existing Thysanura, and that the Symphyla give us hints as to what

their immediate predecessors may have been like. Many of the features that appear to link them with the Malacostracous Crustacea are undoubtedly the results of parallel or convergent evolution, but there remain indications, not to be lightly dismissed, of some degree of genetic affinity between the two groups. There, for the present, speculation must stop. From the Devonian back to the Cambrian we find here and there odd fossils that hint at unsuspected possibilities of Arthropod evolution. Some day, perhaps, palaeontologists may light on a deposit that, by a fortunate accident like that which has preserved the wonderful fauna and flora of the Rhynie Chert, will give us the clue to the origin of insects.

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OBITUARIES

RICHARD BENTLEY (1854-1936), who died on 23 February, joined the Society in 1890. He was formerly head of the famous publishing house of Richard Bentley & Son. He succeeded his father in 1895, and also followed his father in the editorial chair of 'Temple Bar', the magazine which had absorbed the earlier 'Bentley's Miscellany', started by the first Richard Bentley, the founder of the firm in 1837 with Charles Dickens as its first editor. Owing to his father's ill-health the weight of the business had already rested on his shoulders for many years. He retired to his Buckinghamshire house at Upton, and devoted his time largely to the study of meteorology, botany and other sciences.

He was President of the Royal Meteorological Society in 1905-6, Fellow of the Society of Antiquaries and of the Royal Geographical, Linnean, Statistical and Royal Botanic Societies. He was Master of the Stationers' Company in 1924-5 and Vice-President, and for over 25 years one of the treasurers of the Royal Literary Fund.

For many years he was closely associated with the management of King Edward VII Hospital, Windsor.

He was much interested in railway-travel, and had held a season ticket on the G. W. Railway continuously for 63 years—from the time when the engine-drivers and firemen wore white jackets and the signalmen tall hats.

Mr. Bentley's keen interest in meteorology was possibly inherited from his father, who as long ago as 1873 began keeping records of rainfall at Upton, and these records, with the addition of the registration of sunshine from 1898, his son Richard continued for the rest of his own lifetime. His Presidential Address to the Royal Meteorological Society on 'Weather in Warfare' was destined to be consulted with avidity some eight or ten years later by young newly gazetted officers awaiting orders to proceed overseas for service with the Meteorological Section, R.E.

He was one of the few remaining figures connected with the great Victorian age of literature. LUCY R. BENTLEY.

JOSEPH THOMAS CUNNINGHAM (1859-1935).—Cunningham was born in London in 1859, the son of a solicitor of Irish extraction. He received his early education at St. Olave's Grammar School. In 1887 he went to Oxford as a Brackenbury Scholar of Balliol. His Oxford career was brilliant, with the result that he got a First in Mathematical Moderations, and in the Final Honours School of Natural Science. Also, since he had a great fondness for the Classics, his education

was anything but narrow. Most of his vacations were spent in Lyons, where he acquired a fluency in French which made that language almost a native tongue to him.

In 1882 he was made a Fellow of University College and in the same year published his first scientific paper. On leaving Oxford he became assistant to Lancaster at University College, London. Thence he went to Naples, and developed a taste for marine biology which exerted such a controlling influence on his life's work. It seems fitting that his next move should be *viâ* Edinburgh to work on that early marine laboratory 'The Ark' at Granton, where he studied the 'Reproductive elements in *Myxine*', an early effort on which he always looked back with pride.

Cunningham in 1886 married Sophie, a daughter of W. H. Crossfield of London. They had one son, who was killed early in the War while his parents were at the British Association Meeting in Australia. This was a blow which almost shattered Cunningham and certainly left an ineradicable mark upon him. He moved south in 1887, when he joined the staff of the Marine Biological Association at Plymouth, and there he carried out some magnificent work. His 'History of the Common Sole' has not been surpassed, and his studies of the life-histories of fishes did a great deal towards breaking new ground. It is also worthy of note that all the work which is still being done on the vertical movements of marine plankton is due to Cunningham's original observations.

Plymouth, however, did not offer him the opportunities he wanted, so he accepted a post under the Cornwall County Council to lecture to fishermen on their means of livelihood. That experience, I think, left him with a very low regard for the powers of intelligent deduction possessed by people untrained scientifically. In 1902 he returned to London and for a time taught zoology in Chelsea Polytechnic, later (1917) holding the post of Lecturer in Zoology in East London College. Before taking the latter position he went to St. Helena to carry out from an economic standpoint a survey of the marine invertebrates and fishes. The report of this work was deposited at the Colonial Office.

The war period witnessed in Cunningham as in others the assumption of the war-like garb of 2nd Lieutenant. During this time his thoughts on speculative biology were committed to paper. His leanings were towards Lamarckism, but he was by no means unprepared to listen to other views, although he often enough dismissed them with but little ceremony. This was not due to bigotry but to a simple aversion to loose thinking or the facile explanations which were so often offered in opposition. In 1926 he retired from teaching and

devoted his time to research, with an occasional summer afternoon on the bowling-green and an evening at bridge, for he was essentially a social being. It was during his retirement that he had, as he said, time to think; but he seems to have had that always, for he published major speculations in 1900 in 'Sexual Dimorphism in the Animal Kingdom', in 1922 'Hormones and Heredity', as well as his 'Modern Biology' in 1928.

By this time the years had slipped past, but Cunningham seems to have paid them scant notice, for when, in 1930, he and I set out for the Amazon in search of *Lepidosiren* he appeared to be as young as ever. The tropics agreed with him and stimulated him, although at times delays and disappointments were irksome. I shall say little about this expedition, because, though large to me, it was but a small part of the life of my colleague. Suffice it therefore to say that we got ample direct evidence to confirm his theory of the oxygen-emitting function of the vascular filaments developed on the hind limbs of the male in the breeding-season.

After this brief and inadequate summary of his work we must pass to an appreciation of the man himself. Cunningham was 70 years of age before I came to know him intimately. We were thrown together in such a way that each saw the best and the worst of the other in the bright light of primitive conditions. After some six months alone with him in Brazil I think I can fairly say I knew him.

His most striking characteristic was his absolutely ruthless determination. To settle a point or collect data there was no difficulty nor danger he would not face, and withal he was physically a timid man. When in the right mood he was a happy companion, with a pretty turn of wit and a great knowledge and love of poetry and literature. He was inherently kind-hearted, and had on more than one occasion caused himself financial embarrassment through helping people whose lot he considered to be desperate. Unfortunately he had moments of extreme gaucherie and a sharpness of tongue in debate which turned potential friends to enemies. But for these failings he would probably have held greater posts and received greater honours in the biological world than he did; but these would not have made him a greater biologist, nor will their absence induce posterity to believe that he was not a brilliant man.

D. M. REID.

GEORGE ALEXANDER GAMMIE (1864-1935), who died at Chiswick in 1935, had been a Fellow since December 1899. His father, James A. Gammie, was Head Gardener of the Bengal Government Cinchona Plantation near Darjeeling. The rich flora of the district stimulated Gammie's early interest

in plants, which was recognised by his official superiors. Although from 1881 until 1899 he was officially an assistant in the Cinchona Department, during that period he was repeatedly deputed for botanical work outside that Department. During part of 1891-2 he was on deputation to the North-West (now the United) Provinces to officiate as Director of the Botanical Department of Northern India. In 1892-3 he made a botanical tour in Sikkim, and thereafter held charge of the Lloyd Botanic Garden in Darjeeling.

In 1894, after a botanical expedition in the Lakhimpur District of Assam, he was appointed to officiate as Curator of the Herbarium of the Royal Botanic Garden, Calcutta, and continued to do so until 1896. After completing his term as Curator he collected in Chamba and Kangra in the N.W. Himalaya.

In 1899 his services were transferred to the Government of Bombay, and he was appointed Lecturer on Botany and Agriculture in the College of Science at Poona, and soon thereafter also Officer in charge of the Botanical Survey of the Bombay Presidency. From 1904 until 1908 he was Economic Botanist to the Government of Bombay, and from 1908 until his retirement in 1919 he held the post of Imperial Cotton Specialist, that was mainly concerned with the study and improvement of the cotton crop in the Bombay Presidency.

During his service under the Bombay Government he travelled and collected extensively in Western India. His published papers reflect the two sides of his botanical work, some being mainly systematic and others being chiefly of economic interest.

In person he was an unassertive, genial, slow-moving man of massive build and fair complexion, welcome in any company. He was a great favourite at the annual conferences of the Indian Imperial Board of Agriculture in its early years, now far away and long ago, when delegates from the Government of India and all the Provincial Governments and some of the Native States used to meet at a large camp, making a temporary small town of tents, at Pusa in Bihar. A. T. G.

JOHN KITCHING, who passed away at the age of 81 on 28 March 1935, was connected with a number of learned societies, namely, The Royal Geographical Society, The American Geographical Association, The Zoological Society, etc. He was also a member of the Athenaeum Club and the London Chamber of Commerce. He held a wide interest in the old North-Eastern Railway, and was Chairman of the Avila and Salamanca Railway of Spain. He was elected a Fellow of the Linnean Society in 1914.

W. H. KITCHING.

HENRY FAIRFIELD OSBORN (1857-1935) was born at Fairfield, Connecticut, in 1857, his father being William Henry Osborn, the founder and for many years president of the Illinois Central Railroad.

Educated at the Columbia Grammar School of New York Osborn entered Princeton in 1873, and in 1877, having meanwhile been stimulated by the palaeontological discoveries of Cope and Marsh, made the first of his many field expeditions. On this occasion, as in the following year, the work in Colorado and Wyoming was shared by his life long friend Professor William Berryman Scott.

The year 1879 marked a very important point in his career, when he came to this country and at Cambridge came under the influence of Balfour. He joined Christ's College, and always retained the happiest memories of his stay there. During this period he also attended Huxley's lectures in London, of which, as of his one meeting with Darwin, he has left his own account. In England he laid the foundation of many permanent friendships, notably with the Darwin, Huxley and Poulton families.

On his return to the United States in 1881 Osborn was appointed Assistant Professor in Natural Sciences at Princeton, in 1883 Professor of Comparative Anatomy, and in 1891 Da Costa Professor of Biology in the Columbia University of New York. At this time he was also appointed Curator in the Department of Vertebrate Palaeontology in the American Museum of Natural History, a post that he held until his retirement in 1933. Of this department he was virtually the founder, and throughout his life its gradual development to its present eminence occupied his main energies. In 1899 Osborn became associated with Jesup in the administration of the whole museum, and from 1899 until his own retirement in 1933 succeeded him as President of the Board of Trustees. This was a period of great expansion of every department of the museum.

Osborn's output of written work was large. The bibliographic list of his publications is not far short of a thousand titles, ranging from letters to the press on various subjects up to a series of books. His earliest line of scientific investigation was physiological—a study of the origin and function of the corpus callosum,—but he soon turned, as his main interest, to vertebrate palaeontology, especially of the mammals. He was interested, however, from time to time in the extinct reptiles, especially the Dinosaurs, and we owe to him the recognition of the importance of the structure of the reptilian skull in the classification of the main lines of evolution in that group. The terms 'diapsid' and 'synapsid', now in universal currency, are of his coinage,

as are also many of the terms used in the cusp nomenclature of mammalian teeth, the result of his share in the 'Cope Osborn' theory of trituberculy.

In addition to this large series of specialized papers Osborn produced some large monographs, frequently with the willing assistance of his pupils and colleagues, notably Professor W. K. Gregory, such as that on the extinct Equidae of North America or the two volumes on the Titanotheres, the last a monument which will be equalled if not surpassed by the monograph on the Proboscidea on which he was at work at the time of his death. The first volume was already completed and the second sufficiently advanced to render its ultimate publication possible. Osborn's volume on 'The Age of Mammals' is a classic, and in addition he published a considerable number of works on scientific subjects addressed to the general reader.

In the course of a long career as a teacher Osborn had many pupils who in time ripened into colleagues and friends. He liked always to call them his 'sons', and their pupils in turn his 'grandsons'. As a teacher he was stimulating, always encouraging, and never resentful of a view that did not coincide with his own. He was fortunate in being possessed of a considerable sense of fun. He found, or made, time to travel widely, knew the continent of Europe well and this country intimately, and in addition made several journeys not only to the principal fossil-bearing localities of the United States but as far as Egypt and Mongolia.

His work was widely recognized by honorary membership of many learned societies both in the United States and abroad. His election as a foreign member of the Royal Society, and the award in 1918 of the Darwin medal, gave him great pleasure, as did his election in 1906 as a Foreign Member of this Society. In this country he was an honorary Doctor of Science of Cambridge, an honorary Fellow of the Zoological, the Literary and Philosophical of Manchester, the Royal Society of Edinburgh and the Geological Societies. Of the last-named society he received in 1926 the award of its Wollaston Medal.

No account of Osborn could be complete without mention of his wife Lucretia Perry Osborn. She predeceased him in 1930, but for forty-nine years she was a constant source of inspiration and encouragement to him. Her death was a blow from which he perhaps never fully recovered, although exteriorly at least he recovered his normal quiet serenity.

He died peacefully at his work-desk at Castle Rock on the morning of 6 November 1935, aged seventy-eight years.

C. FORSTER COOPER.

ARTHUR H. PATTERSON, A.L.S. (1857-1935).—By the death of Arthur Patterson, which took place in his native town of Great Yarmouth on 17 October 1935, in his seventy-ninth year, there passed away a Norfolk naturalist of the type of Thomas Edward, immortalized by Smiles. Like Edward, Patterson was born of very humble parentage, for his father was a shoemaker in a Yarmouth Row in one of the poorest parts of the town and, like Edward, he was of Scottish descent. He came of a tuberculous stock and was the only member of his family to reach adult life.

Starting as a boy in a chandler's shop he became successively a pupil teacher, insurance agent, supernumerary postman with an 8-hours' day at twelve shillings a week, draper's assistant and keeper at a zoo in Ireland, from which he returned to Yarmouth with only 2½d. in his pocket for his wife and children. Realizing his worth some naturalist friends in the county then helped him with a private subscription fund, and through their influence he was appointed, in 1891, a school attendance officer in his native town, from which position he eventually retired with a small pension. This post insured for him the out-of-door life which was so essential to his health.

Gifted with a ready journalistic pen and an aptitude for pen-and-ink sketches Patterson did much to popularize the study of natural history through the columns of the local press, and the 'scribblings' of 'John Knowlitt' were eagerly read by a large circle of its readers. Considering that he was entirely self-educated great credit is due to his memory for the several books that he published. These, such as 'Wild Life on a Norfolk Estuary', were based upon a carefully kept diary, and chiefly have reference to Breydon Water, on which he spent most of his leisure time in his house-boat. He has also placed on record the doings and sayings of many of the old punt-gunners and fishermen of this well-known tidal estuary, where Booth obtained so many of his specimens now preserved in the Dyke Museum. On the other hand, Patterson suffered from the want of any scientific training, which resulted in a laxity of proof in some of his records. He was best informed on the British marine and freshwater fishes, and in these groups was always careful to get his identifications confirmed by the authorities at the South Kensington Museum. He contributed a number of papers to the 'Transactions of the Norfolk and Norwich Naturalists' Society', of which he was made an honorary member, and in 1935 had the distinction of being elected an Associate of the Linnean Society. He was a true lover of Nature and of the wild, and deserves to go down to posterity in the long line of Norfolk naturalists. SYDNEY H. LONG.

BENJAMIN LINCOLN ROBINSON (1864-1935) was best known to botanists on this side of the Atlantic for his keen interest in the family Compositae, particularly the tribe Eupatorieae, of which he was the recognized authority, and he paid many visits to this country in connection with that group.

Robinson was born at Bloomington, Illinois, on 8 November 1864, and graduated at Harvard in 1887. Afterwards he studied under de Bary at Strassburg, and obtained his Ph.D. at the Kaiser-Wilhelm University for a paper on the stem-anatomy of *Phytocrene macrophylla* Bl.

On his return to America he was appointed assistant to Sereno Watson at the Gray Herbarium, and he succeeded the latter as Curator in 1892. Under Robinson's curatorship the herbarium was transferred to a larger and more modern building, with more adequate funds for its upkeep, and ever since it has maintained a very high standard of work. Robinson was appointed Asa Gray Professor of Systematic Botany at Harvard in 1900.

Besides being a Foreign Member of our Society Robinson received wide recognition by his election to numerous societies in America and abroad.

Dr Robinson was a typical example of the 'old school' of systematic botany, and as Merrill says ('Science', 1935, p. 142), 'America, on July 27th, 1935, lost the last of that older group of men who . . . built so solidly and well for the future'. Besides his intensive studies on the Eupatorieae he edited part of the 'Synoptical Flora of North America', begun by Asa Gray and S. Watson, and for twenty-nine years edited 'Rhodora'.

In addition he edited, in collaboration with M. L. Fernald, the seventh edition of Gray's 'Manual of Botany', the standard flora of the north-eastern United States. J. HUTCHINSON.

IDA M. ROPER (1865-1935) was born at Bristol in 1865, and died there on 8 June 1935 after some years of failing health. Throughout her life her keen interest in natural history and archaeology was focussed on the problems of the region round her native city. She was pre-eminently a field botanist, and her knowledge of the plants of the district was rivalled only by that of the late J. W. White. With him she always worked in close association, and the great aid she rendered in his compilation of the 'Flora of the Bristol Coalfield' was freely acknowledged by him. Although her chief interest lay in the flowering plants she also collected mosses, parasitic fungi and galls extensively. She was an authority on monumental effigies, and in 1930 published an exhaustive treatment of the effigies of Bristol and Gloucester.

Her vigorous personality found scope in the affairs of the

Bristol Naturalists' Society, of which she was Secretary and Librarian for nearly twenty years and President from 1913 to 1916. Her tireless work for the society will long be remembered by her many Bristol friends, and a wider circle of botanists will remember her as the genial local secretary of Section K of the British Association during the Bristol Meeting of 1930.

M. SKENE.

REGINALD WILLIAM SCULLY (1858-1935).—Dr. Scully died last May at his home near Cork, aged seventy-seven years; one of the last of the group of botanists who, largely under the inspiration of A. G. More, did so much to extend our knowledge of the Irish flora between 1866 and 1898.

Born in 1858, he became a medical man, but was not driven to either general or special practice, although always keenly interested in medicine and surgery. His interest in botanical field studies began about 1885, and he soon became the leading authority on the flora of south-west Ireland. His 'Flora of County Kerry', which appeared in 1916, was his greatest achievement. In 1895 he collaborated with Nathaniel Colgan in the second edition of More's 'Cybele Hibernica', which appeared in 1898. He retained till the end his keen interest in the Irish flora, and as recently as 1931, although crippled by arthritis, he joined the writer on an excursion to try and settle a mystery connected with the supposed occurrence of *Scirpus triquetus* on the river Cashen below Listowel.

Scully was a man of retiring disposition, modest of his own achievements, and a fine example of old-world courtesy.

R. LLOYD PRAEGER.

GERALD LODER—the first Lord Wakehurst, the fourth son of Sir Robert Loder—was born in October 1861, and went to Eton in 1875 and to Trinity College, Cambridge, in 1881. He was called to the Bar, and entered parliament as member for Brighton in 1889, a seat which he held until 1905, when, on seeking re-election on his appointment as a Junior Lord of the Treasury, he was defeated by a Liberal opponent. In 1896 he was appointed a director of the London, Brighton and South Coast Railway, of which line he was later elected chairman. When the Southern Railway Company was formed he became joint deputy chairman, and in 1932 chairman of that company.

Both in politics and in business his work was marked by great attention to detail, by sound judgment, and by hard work. These qualifications he brought to bear in undiminished force on all that appertained to his great hobby, the growing and the study of plants and trees. His hobby was to him no

casual occupation for a leisure day ; it was a life's work pursued with unrelenting diligence and with stern method. He would leave no plant in his garden—or for that matter one that attracted him in a friend's garden—unidentified. He filed a volume of information, culled from the press or gathered from friends, about plant genera that specially interested him. His gardening was done at Wakehurst Place in Sussex, a lovely Elizabethan house which he bought in 1903. The gardens there were practically his creation. Two little formal gardens he laid out near the house ; his lawn was flanked on one side with old trees underplanted with Rhododendrons, and on the other with beds and plantings of rare shrubs. Conifers and specimen trees occupied two large areas of reclaimed park, while, below all, was the great oak-wood, descending to hammer ponds, and filled with every sort and kind of plant.

Conifers, Rhododendrons and hardy flowering shrubs were of special interest to him. At one time he specialized in lilies. His collection of New Zealand plants was unrivalled in this country. Although he never specialized in greenhouse plants, as such, there were a number of plants on the borderline of hardiness which he grew, in winter at any rate, under glass.

Much of his garden work was done outside his garden ; he knew intimately the great gardeners who were his contemporaries ; he visited their gardens and corresponded with them ; he joined and gave of his best to those societies which were associated with his hobby. Chief among them were the Linnean Society, the Royal Horticultural Society and the Royal Arboricultural Society. In 1926-7 he was President of the last-named Society.

From 1920 until just before his death he was on the Council of the Royal Horticultural Society, and in 1926 and 1927 he was its President, resigning this office only when he became Chairman of the Southern Railway. While he was on the council he was chairman or member of innumerable committees, of which he rarely missed a meeting.

He became a Fellow of the Linnean Society in 1914 ; served on the Council during 1915-8, 1919-23, 1929-33, and was a Vice-President in 1930-1. His working knowledge of Botany and his wide acquaintance with botanical and gardening books, added to the fact that he was a man of business and of affairs, made him of great use to the Society in these offices.

Always a busy man, never wasting a moment of his time, he was never too busy to help a friend or colleague to solve a knotty problem ; never too busy to advise when his advice was asked ; never too busy to undertake a fresh task when

it was proved to him that he was the man to undertake it ; a man who always set his work before his comfort ; in short, a man who was an ideal colleague in all that he undertook.

He died at Wakehurst on April 30 1936 in his seventy-fifth year.

ABERCONWAY.

FRIEDERICH AUGUST FERDINAND CHRISTIAN WENT (1863-1935), Foreign Member of the Linnean Society, was born in Amsterdam on 18 June 1863. He was a student in Amsterdam under De Vries, and gained his doctorate for a thesis entitled 'De jongste toestand der vacuolen' in 1886. Thereafter he worked for a short time under Strasburger at Bonn and van Tieghem in Paris. After teaching for some years he was awarded a scholarship, which enabled him to visit Buitenzorg, and, in 1891, he became the director of the Experimental Station at Kagok in West Java. In 1896 he returned to Europe to the Chair of Botany at Utrecht, which he held for thirty-seven years. This long tenure was broken only by lengthy voyages to Ceylon, Java and Japan. On his retirement in 1934 he was appointed to a special Chair in the University of Leiden, and this he occupied till his death on 24 July 1935.

As a teacher and administrator Went was held in the highest esteem. When he went to Utrecht he was the only member of the botanical staff, and he had to undertake the teaching of the whole range of botanical science in very modest quarters. During his term of office he directed the expansion to the present impressive institute with its large staff. His experience and achievements as Director of the Station at Kagok led him to be regarded as the leading authority on tropical botany, and he always insisted on the necessity of laying sound scientific foundations for the study of the problems connected with tropical agriculture.

The magnitude of his scientific work is indicated by the fact that his publications numbered no less than 179, and that 59 doctorate theses were produced under his direction. The range of his interests was no less remarkable. His first work was cytological. In Java he investigated the carbohydrate metabolism of the sugar-cane and also the diseases of this and of other tropical crop plants. He published work on the algae, on the fungi and on the biology and morphology of the higher plants. His papers on the Podostemonaceae were specially important. But it is in connection with physiological problems that his work and that of the Utrecht school, which owed its inspiration to him, has become best known in recent years. His students extended F. F. Blackman's work on the relation of temperature to photosynthesis to other physiological problems, and attention

was directed to the analysis of stimulus reactions. The discovery of auxin and the experimental work on it, both from the chemical and physiological sides, was carried out by others, but owed its inception to Went. This work was suitably summed up by him in a paper in 'Biological Reviews' only last year. It has opened up an entirely new field of investigation.

All those who saw this quiet and authoritative man at Cambridge during the International Congress in 1930 must have felt keen regret that he did not live to take his natural place at the head of the Congress of 1935 in Amsterdam.

M. SKENE.

FRIEDRICH ZSCHOKKE (1860-1936) was born in Switzerland, in Aarau, where he spent his early years. In 1880 he went to Lausanne and studied zoology under Vogt. His work there was a study of the morphology of the Cestoda. In 1885 he went to Leipzig to Leuckart's laboratory, where he remained for a year. After spending the winter of 1886-7 at Naples he settled in Basel, where he was to spend the remainder of his life. Zschokke's studies of the parasitic worms, particularly the Cestoda, very soon earned him an international reputation. But Zschokke did not confine his attention to parasites, for soon after his arrival in Basel he had begun to investigate the freshwater fauna of the district, being led to this by the fact that many of the animals composing the freshwater fauna acted as intermediate hosts of the parasitic worms. These studies of the local freshwater fauna he continued side by side with his investigations of the life-history, morphology and distribution of the parasitic worms for the rest of his life. His studies of the local fauna were soon extended to cover a wider range, to alpine lakes and to the waters of western and central Europe.

In 1900 Zschokke published 'Die Tierwelt des Hochgebirgseen', and ten years later 'Die Tiefseefauna der Seen Mitteleuropas'. In these two large monographs he collected together a large number of his own observations and those of other workers to show that the animals discontinuously distributed in alpine lakes and in the cold waters of the deep lakes are stenothermic forms. He showed also that there is in lakes no specialized abyssal fauna such as exists in the depths of the ocean. He ascribed the origin of this fauna inhabiting cold water to the Ice Age, and showed beyond all doubt that the distribution of these stenothermic forms could only be explained on the hypothesis that they had once been continuously distributed and had subsequently been relegated to their present habitats by the amelioration of climate and the general rise of temperature which followed

the retreat of the glaciers after the last Ice Age. These faunistic studies established for Zschokke a second international reputation as a hydrobiologist.

In his studies of the fresh waters of central Europe Zschokke travelled extensively, for he liked travel and he took an aesthetic delight in the appreciation of scenery; but he did not travel alone, for he liked companionship in travel, particularly the companionship of youth. Few professors can have gained the sympathy of the student so completely as did Zschokke. Tall and upright, he commanded their respect in his lectures, which were models of clear exposition, and he won their hearts when he led parties in the field to collect the local fauna. Year by year students accompanied him when he went to collect in the Swiss lakes. Zschokke enjoyed every minute of these expeditions from the time when he set out in the morning to the evening, when he led the students in song as they sat in the parlour of the local inn. On Zschokke's seventieth birthday there was established the 'Friedrich Zschokke Stiftung', the object of which was to make it possible for future students and their teachers to enjoy and to profit from zoological expeditions such as those which had been such a feature of Zschokke's life and teaching.

After having been Professor of Zoology in the University of Basel since 1893 Zschokke retired in 1931. He was then a sick man, but his sturdy constitution enabled him to withstand and to recover from a severe operation. After this his activities were severely limited, but he managed to pay a visit to Naples, where he had worked at the outset of his career. He died after a short illness on 10 January 1936 in his seventy-sixth year.

J. T. SAUNDERS.

BENEFACTIONS

LIST *in accordance with Bye-Laws, Chap. XVII. Sect. 1, of all Donations of the amount or value of Twenty pounds and upwards, received during the past Twenty years.*

1916

- Mr. E. Heron-Allen: Contribution to cost of paper on Foraminifera of N.W. Scotland, £44.
 Messrs. H. Takeda and C. West: Contribution towards the illustration of their paper, £40.
 Royal Society: Contribution towards the illustration of two papers by Prof. Dendy, £40.
 The same: Contribution towards Mr. Swynnerton's paper on Form and Colouring, £70.
 The High Commissioner for the Union of South Africa, per Dr. J. D. F. Gilchrist, for the illustration of his paper on *Jasus Lalandii*, £30.
 Miss Marietta Pallis: Balance of cost of her paper on Plav, £90 16s. 6d.
 Sir Frank Crisp, Bt.: Phototyped copy of Dioscorides from the 'Codex Anicae Julianae' at Vienna.

1917

- British Ornithologists' Union, etc.: Contribution towards cost of Mr. H. N. Ridley's paper, £20.
 The Royal Society: Second contribution towards the printing of Mr. C. F. M. Swynnerton's paper on Form and Colouring, £75.
 Sir Frank Crisp, Bt.: 'Lindenia', Ghent, 1891-1901. 17 vols. sm. fol.

1919

- Dr. B. Daydon Jackson: MS. index to Linnean Society's Journal, Botany, vols. xxi-xl (1884-1912) and the botanic entries in the 'Proceedings' for the same period.

1920

- The Royal Society : Third contribution towards the printing of Mr. C. F. M. Swynnerton's paper as above, £50.
- The High Commissioner for the Union of South Africa, for the printing of Dr. J. D. F. Gilchrist's paper on *Jasus Lalandii*, Part II, £60.

1921

- The Percy Sladen Memorial Fund : Additional Grant in aid of publication of 'Transactions', 2nd ser., Zoology, vol. xvii, part 4, £72 10s.
- The same : Grant in aid of publication of four papers on the Houtman Abrolhos Islands, £100.
- The Royal Society : Donation in aid of papers by Mr. N. E. Brown and Mr. S. L. Moore, £90.
- Dr. W. Rushton Parker : Donation of a large series of portraits of Naturalists and Persons after whom Genera have been named, and work on rearrangement and annotation of the entire collection.
- Prof. C. S. Sargent, F.M.L.S. : Eight volumes issued by the Arnold Arboretum including 'The Bradley Bibliography'.
- Dr. B. Daydon Jackson : MS. Catalogue of each sheet in the Linnaean Herbarium ; bound in two volumes folio.

1922

- The late Sir Joseph Hooker : Donation of his Medals and Decorations. (Reversion to Linnean Society on Lady Hooker's decease.)
- Anonymous donation in aid of publication of the late Dr. E. A. Newell Arber's paper, entitled 'Critical Studies of Coal-Measure Plant-impressions', £60.
- The Percy Sladen Memorial Fund : Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xviii, pt. 1.

1923

- Dr. W. Rushton Parker : (1) Donation of Oxford New English Dictionary ; vols. i-x, 1888-1928, and Supplement, 1933, 4to. (2) Encyclopaedia Britannica : ed. XI, Cambridge, 1920-2. 32 vols. 4to.
- E. Heron-Allen, Esq., F.R.S. : Contribution of £25 towards the cost of paper on the Foraminifera of Lord Howe Island.

1924

The Percy Sladen Memorial Fund: Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xviii, pt. 2.

1925

Mr. Reginald Cory: New Presidential Chair, emblazoned with the Arms of the Society.

1926

Subscription portrait of Dr. B. D. Jackson, R.N.O.

Mr. A. D. Michael: A large number of Books and Pamphlets from his Library.

The late Mr. A. O. Walker: £200 free of Legacy Duty.

An Anonymous Donor: £100 to establish a Fellowship in memory of the late Prof. E. A. Minchin, F.R.S., Sec.L.S.

The Royal Society: Donation in aid of publication of Mr. G. P. Farran's paper on Biscayan Plankton.—Part 14. The Copepoda, £60.

The late Mr. Frank Morey: £100 free of Legacy Duty.

The late Mr. George Lewis: Books and pamphlets on Entomological subjects.

Capt. E. G. Spencer-Churchill: A copy of a collotype reproduction of 'The herbal of Apuleius Barbarus... (MS. Bodley 130)'.

The Percy Sladen Memorial Fund: Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xix, pt. 1.

1927

The late Mrs. Mary Anne Stebbing: £100 less Legacy Duty.

1928

Carnegie United Kingdom Trust: £666 13s. 4d. for purchase of books.

The Royal Society: £160 (£85 in aid of the publication of Dr. G. Enderlein's paper on 'Die Copeognathen der Seychellen', £75 in aid of Mr. C. V. B. Marquand's paper on 'The Botanical Collections made by Capt. F. Kingdon Ward in the Eastern Himalaya and Tibet in 1924-5').

1929

Carnegie United Kingdom Trust : £666 13s. 4d. for purchase of books.

The Percy Sladen Memorial Fund : £100 in aid of the publication of papers on the Fauna of the Paraguayan Chaco.

Carnegie Trust for the Universities of Scotland : £28 in aid of the publication of papers on the Fauna of the Paraguayan Chaco.

1930

Carnegie United Kingdom Trust : £666 13s. 4d. for purchase of books.

An Anonymous Donor : £23 towards the purchase of an Epidiascope.

The Royal Society : £100 in aid of the publication of Mr. H. W. Pugsley's paper, 'A revision of the British *Euphrasiae*' and Dr. T. A. Sprague's paper, 'The Herbal of Leonhart Fuchs'.

Mrs. B. Daydon Jackson (the late) : valuable reversion under her Will after three life-tenants shall have died.

Mr. B. B. Woodward (the late) and Mr. A. S. Kennard : a portion of Mr. Woodward's scientific library and reversion of the remainder.

1931

Miss E. C. Hatchett Jackson : Bust of Charles Hatchett, F.L.S., by Chantrey.

Major Vivian Seymer : Volumes from the Library of Henry Seymer.

Exors. of the late Dr. E. J. Bles : Donation in aid of colour collotype plates to illustrate Dr. Karl Peter's paper on *Xenopus laevis*, £100.

Dr. Francis Pierrepont Barnard : Bequest of Sir James E. Smith's seal, his collection of seal impressions, and some portraits.

The Percy Sladen Memorial Fund : Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xix, pt. 2.

1932

Mr. Francis Druce : Donation towards the cost of new books, £50.

The Royal Society: Donation in aid of the publication of papers resulting from Dr. Worthington's Expedition to the East African Lakes, £75.

Subscription portrait of the late Professor Julius von Sachs, F.M.L.S.

Cambridge Expedition to the East African Lakes, 1930-31 (Dr. E. B. Worthington, leader).—Unexpended balance of expedition funds, for the publication of the scientific results, £175.

Carnegie Institution of Washington: Donation of a considerable number of its publications.

1933

The Royal Society: Donation in aid of the publication of Dr. H. Boschma's paper 'The Rhizocephala in the collection of the British Museum', £60.

The Percy Sladen Memorial Fund: Cost of printing and illustrating 'Transactions', 2nd ser., Zoology, vol. xix. pt. 3.

1934

Mr. Francis Druce: Certain legal expenses connected with the Society's interest in the Will of the late Mrs. Jane Jackson, £33 14s.

Mr. Warren R. Dawson, F.R.S.E.: Compilation of 'Catalogue of the Manuscripts in the Library of the Linnean Society of London.—Part 1. The Smith Papers'; and cost of binding the additional series of correspondence, etc.

The Royal Society: Donation in aid of the publication of Dr. G. S. Carter's paper, 'The fresh waters of the rain-forest areas of British Guiana', and Mr. H. N. Dixon's paper, 'A contribution to the Moss flora of Borneo', £85.

The Misses Phipps Tiarks: Copy of portrait of N. B. Ward, F.R.S., F.L.S., by an unknown artist; engraving after Knight's portrait; drawing of Ward's conservatory; and his 'Pitt Club' medal.

1935

The Royal Society: Donation in aid of the publication of Mr. W. T. Stearn's paper, '*Epimedium* and *Vancouveria*, a monograph', and Dr. F. K. Sparrow's paper, 'A contribution to our knowledge of the Aquatic Phycomycetes of Great Britain', £150.

1936

The Trustees of the Will of Herbert Spencer, deceased :
£1241 in payment of bequest.

The Royal Society : Donation in aid of the publication of
Mr. W. R. Philipson's paper, 'A revision of the British
species of the genus *Agrostis* Linn.' and Dr. E. Fischer-
Piette's paper, 'Études sur la biogéographie inter-
cotidale des deux rives de la Manche', £180.

The late Lord Wakehurst of Ardingly : £100 free of Legacy
Duty.

TREASURER'S ACCOUNTS FOR THE

(Presented at the Anniversary

Receipts and Payments of the Linnean Society

			General		
RECEIPTS			£	s.	d.
To Balance at 1 May 1935	715	0	3		
„ Cash in hand	16	3	10		
				731	4
„ Admission Fees				72	0
„ Arrears of Annual Contributions	36	0	0		
„ Annual Contributions for year	2400	0	0		
Do. in advance	102	0	0		
				2538	0
„ Composition Fees				141	0
„ Interest on Investments (including Income Tax recovered)				309	2
Do. Deposit				5	11
Do. Post Office Savings Bank Account				9	3
„ Sales of Publications :—					
Transactions	16	10	9		
Journals	140	18	2		
Proceedings	13	19	2		
Library Catalogue	1	18	9		
Catalogue of Manuscripts	4	17	6		
				178	4
„ Donations in aid of Publications				150	0
„ Donations for General Purposes				1	0
„ Miscellaneous Receipts				26	1
				£4161	6
					8

			Library		
RECEIPTS			£	s.	d.
To Balance 1 May 1935	92	4	0		
„ Interest on Investments (including Income Tax recovered)	48	5	0		
„ Transferred from General Account	400	0	0		
				£540	9
					0

			Fellows Postal		
			£	s.	d.
To Balance at 1 May 1935	61	9	8		
„ Deposits during year	6	0	5		
				£67	10
					1

YEAR ENDED 30 APRIL 1936.

Meeting, 28 May 1936.)

from 1 May 1935 to 30 April 1936.

Account

	PAYMENTS	£	s.	d.	£	s.	d.
By Coal, Electric Current, and Gas.....		98	5	7			
„ Furniture.....		14	1	9			
„ Repairs: Sundry		8	7	9			
„ Taxes and Insurance		61	17	8			
„ Miscellaneous Printing and Stationery.....		151	6	1			
„ Petty Expenses (including Tea and Postage)		171	10	8			
„ Publications:—							
Printing	920	6	0				
Illustrations.....	141	12	10				
Distribution.....	44	4	1				
					1106	2	11
„ Salaries and Wages, etc.		1192	2	6			
„ Transferred to Library Account		400	0	0			
„ Zoological Record: Donation for 1935							
volume		15	0	0			
„ Freshwater Biological Association:							
Donation		5	5	0			
„ Purchase of £93 4s. 9d. 3½ per cent.							
Conversion Stock (Staff Pension							
Fund)		100	0	0			
„ Purchase of £132 2s. 8d. 3½ per cent.							
War Stock (Investment of Com-							
position Fees)		141	0	0			
„ Linnean Medal		15	15	0			
„ Jubilee Decorations		17	10	0			
„ Windsor Herald: Vellum Sheet		10	10	0			
„ Balance at 30 April 1936:—							
Current Account at Bank.....	89	4	0				
Deposit „	150	0	0				
„ „ Post Office Savings							
Bank	400	0	0				
Cash in hand	13	7	9				
					652	11	9
					£4161	6	8

Account

	PAYMENTS	£	s.	d.
By Books		26	16	11
„ Periodicals.....		338	12	0
„ Binding		142	10	6
„ Balance at 30 April 1936		32	9	7
		£540	9	0

Account

	£	s.	d.
By Postage during year.....	5	19	2
„ Balance at 30 April 1936	61	10	11
	£67	10	1

Separate Account.

To Balance at 1 May 1935 :—		£	s.	d.
Westwood Fund	£32	6	4	
Trail Award Fund	18	1	8	
Crisp Award Fund	61	14	7	
Hooker Lecture Fund	88	9	2	
Goodenough Fund	1	0	3	
Minchin Fellowship Fund	6	7	6	
		207	19	6
Interest on Investments (including Income Tax recovered) :—				
Westwood Fund	£11	15	0	
Trail Award Fund	3	10	0	
Crisp Award Fund	7	10	0	
Hooker Lecture Fund	22	14	0	
Goodenough Fund	9	4	4	
Minchin Fellowship Fund	5	0	0	
Staff Pension Fund	33	18	3	
		93	11	7
By Goodenough Fund :—				
Transferred to Annual Contributions				£301 11 1
Hooker Lecture Fund : Award to Lecturer				26 5 0
Minchin Fellowship Fund :—				
Transferred to Annual Contributions				4 0 0
Westwood Fund : cost of Illustrations				14 14 5
Staff Pension Fund :—				
Purchase of £32 5s. 3d. 3½ per cent. Conversion Stock				33 18 3
Balance at 30 April 1936 :—				
Westwood Fund	£29	6	11	
Trail Award Fund	21	11	8	
Crisp Award Fund	69	4	7	
Hooker Lecture Fund	84	18	2	
Goodenough Fund	14	7		
Minchin Fellowship Fund	7	7	6	
		213	3	5
				£301 11 1

30 April 1936.

General Account

£	s.	d.	£	s.	d.
1000	0	0	Metropolitan 3 per cent. Stock 1941	@105½	105½ 10 0
1200	0	0	India 3 per cent. Stock	@86	1032 0 0
1000	0	0	Eastern Bengal Railway 4 per cent. Irredeemable Debenture Stock	@105½	1055 0 0
1000	0	0	Great Western Railway 4 per cent. Debenture Stock	@115½	1155 0 0
312	0	0	London Midland & Scottish Railway 4 per cent. Preference Stock	@87	271 8 10
3296	0	0	4½ per cent. Conversion Stock 1940-44	@111½	3675 0 10
132	2	8	3½ per cent. War Stock	@105½	139 14 7
			£8380	14	3

Library Account

£	s.	d.	£	s.	d.
450	0	0	Forth Bridge Railway 4 per cent. Stock (Bentham Bequest)	@105½	474 15 0
200	0	0	4½ per cent. Conversion Stock 1940-44 (Walker and Morey Bequests)	@111½	223 0 0
530	0	0	East Indian Railway 3½ per cent. Debenture Stock (Tagart Bequest)	@95½	506 3 0
88	9	8	London County 5 per cent. Stock 1940-60 (Stebbing Bequest)	@111	98 4 4

Separate Account

£	s.	d.	£	s.	d.
£1063	10	7	Metropolitan Water Board 3 per cent. "B" Stock (Westwood Fund)	@97	225 5 8
			Ditto	@97	647 13 5
			Ditto	@97	158 13 3
			New South Wales 3½ per cent. Stock, 1930-50 (Trail Award Fund)	@101	101 0 0
			2½ per cent. Consolidated Stock (Crisp Award Fund)	@85½	256 10 0
£315	4	5	India 3½ per cent. Stock 1931 (Westwood Fund)	@98	126 18 8
			Ditto	@98	60 13 3
			Ditto	@98	121 6 6
			Ditto	@111	111 0 0
			London County 5 per cent. Stock 1940-60 (Minchin Fellowship Fund)	@107½	1150 15 3
			3½ per cent. Conversion Stock (Staff Pension Fund)		
			(£15 18s. 7d. Ditto, to be transferred on 1 May 1936.)		
			£1302	2	4

FRANCIS DRUCE, *Treasurer.*

We have (in conjunction with the Professional Auditor, who certifies as to all details) audited the Accounts of the Society for the year ended 30 April 1936, and found them correct. We have verified the Investments and Bank Balances.

Dated this 13 May 1936.

W. B. KEEN, *Chartered Accountant,*
23 Queen Victoria Street,
London, E.C. 4.

W. T. CALMAN,
W. NEILSON JONES,
J. HUTCHINSON,
D. J. SCOURFIELD,
J. R. NORMAN,
J. RAMSBOTTOM,

Auditors.

ADDITIONS AND DONATIONS

TO THE

LIBRARY

1935-36

Note.—Names of donors are given in square brackets. Separate copies of papers which are included in periodicals received by the Library are no longer catalogued.

Andrewes, H. E. The Fauna of British India. Coleoptera, Carabidae; Vol. 2, Harpalinae, 1. Pp. xvi+323. 8vo. *London*, 1935.

[SECRETARY OF STATE FOR INDIA.]

Ardley, R. A. B. See *Discovery Reports*. Vol. 12.

Audas, J. W. Native Trees of Australia. Pp. 296. 8vo. *Melbourne*, n.d.

[AUTHOR.]

Baylis, H. A. The Fauna of British India. Nematoda; Vol. 1. Ascaroidea and Strongyloidea. Pp. xxxvi+408. 8vo. *London*, 1936.

[SECRETARY OF STATE FOR INDIA.]

Berger, Alwin. Die Entwicklungslinien der Kakteen. Pp. iv+105. 8vo. *Jena*, 1926.

[Professor F. E. WEISS.]

Bernhardi, J. J. Beobachtungen über Pflanzengefäße und eine neue Art derselben. Pp. vi+82. 8vo. *Erfurt*, 1805.

[Professor F. E. WEISS.]

Blackburn, H. The Pyrenees: a description of summer life at French Watering Places. Pp. xiv+250. 8vo. *London*, 1881.

Botanical Review (The). Vol. 1→ 8vo. *Lancaster, Pa.*, 1935→

Bowles, E. A. A Handbook of *Narcissus*. Pp. 248. 8vo. *London*, 1934.

[AUTHOR.]

British Museum (Natural History).

The John Murray Expedition, 1933-4. Scientific Reports. Vol. 1, No. 1. Introduction and List of Stations. By Lt.-Col. R. B.

SEYMOUR SEWELL. Pp. 41. 4to. *London*, 1935.

[TRUSTEES, BRIT. MUS.]

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[TRUSTEES, BRIT. MUS.]

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